Utzon and the sun path as an organizing element of life in a house

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Developing a Ph.D. thesis about the Jørn Utzon's work

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Introduction

"And it's so nice to have a house. It would seem theatrical if I said that I have a household altar. But that is what I have. This place is my altar. This is where, with the deepest respect, I face nature, and with the greatest passion, contemplate the sun and the land in front of me" Jørn Utzon [1]

Jørn Utzon said this regarding *Can Lis*, a house located on the top of a cliff, twenty meters above sea level, and with an extraordinary view of the Mediterranean Sea. The sun's behaviour in the house is similar to that which takes place in the five temples of the *acropolis of Selinunte* (Sicily, Italy). The orientation of the mentioned temples is eastwards, towards the sunrise. Every morning, the sun briefly shines into the heart of each room in turn. This one moment was capable of making each one of them different from the others, and so, unique. During the month I spent in *Can Lis*, thanks to the scholarship given by the *Utzon Foundation* and the Danish government, I could observe a similar event: the sun gets to the different blocks and rooms in such a way that we can feel how the time passes by, as if we were looking at a sundial.

Fig. 1 Sunrise at *Can Lis*. 7:57 (UTC+1). 8/12/2013 (own photo)

The present text intends to analyze the hypothesis stating that the path of the sun can be an organizing element for how you live in the houses designed by Jørn Utzon. To do so, I have selected twenty houses and building complexes designed by him between the years 1950-94, in Denmark, Sweden, The United Kingdom and Spain. In these projects I will look for elements which are repeated and their possible meaning. The aim is to reach practical conclusions that could help us decide how to orientate a house.

Contents

I. Utzon and the sun

"But all the building complexes that have really inspired me –the desert cities in Morocco, for example– have been pushed into position in relation to the place, and in relation to the sun. Then they take on the character that the old cities or Greek temples have. It's about putting the house and the apartments together such that they harmonize with the landscape and thus provide the best conditions for living there" Jørn Utzon [2]

It is not surprising that the first urban civilizations (3500-3000 BC), having few technical resources to shelter from the weather, settled not far from the parallel 30º [3]. The sun was one of the natural elements that created the best conditions for living in these difficult times when technology was not so developed, and human beings could not protect themselves. Utzon additionally remarks that

the reasons for establishing a relationship between architecture and the sun are not only functional but also meaningful and intangible. The aim is to make it "blend into the landscape". And this harmony is more than merely functional, because it establishes a close relationship between the building and its natural environment.

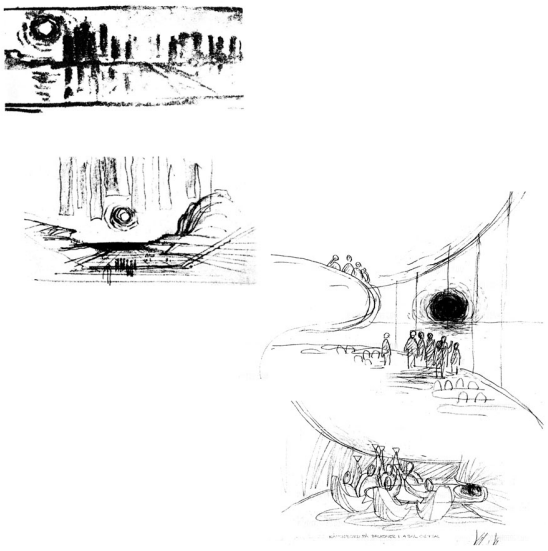

Fig. 2. Utzon's Sketches. Left above, Competition for *Development of Frederiksberg*. Left below, *Copenhagen World Exhibition* (both of them in Copenhagen, Denmark, 1959). Right, Competition for *Langelinie Pavilion* (Copenhagen, Denmark, 1953)

At the beginning of his professional career, we can see that Utzon frequently drew the sun in his sketches. Its disproportionate size and prominent position make it difficult not to notice it. Thus, we can appreciate how important and valuable this element was for him. Two sketches made by Utzon for the competition for *Langelinie Pavilion* are very interesting. Both of them are entirely drawn in pencil except for two elements: the sun and the fire. In spite of the fact that they are to all appearances different from each other, identical colours are used for each: red and yellow. This small detail of highlighting and linking these two similar elements illustrates their importance. The sun and the fire are elements around which life revolves and develops (people living in the house are usually drawn to them). Their light and heat, according to Utzon, *provide the best conditions for living in that place*.

"The houses are arranged like flowers on the branch of a cherry tree, turning towards the sun from each flower's particular position" Jørn Utzon [4]

Utzon compares this way of doing architecture to *organic architecture*, because of its concerns with the relationship with the sun. According to him, architecture "should not try to copy the form of the plants" [5], but the laws and principles that lie beneath their appearance. Like in the cherry tree metaphor, *organic architecture* is designed in relation to the sun and its particular position.

"An understanding of walking, standing, sitting and lying comfortably, of enjoying the sun, the shade, the water on our bodies, the earth and all the less easily defined sense impressions. A desire for wellbeing must be fundamental to all architecture if we are to achieve harmony between spaces we create and the activities to be undertaken in them" Jørn Utzon [6]

Fig. 3. Housing complex in Fredensborg (Helsingør). The sunbeams reach the rear living room wall during winter.

It is precisely the desire to enjoy the sun and the shade that makes him so sensitive to the behaviour of the sun in each place. It is also very interesting how Utzon designs his architecture in relation to the sun differently depending on the geographic latitude. In high latitudes, like in Denmark or Sweden (latitude 55-57ºN), he considers it a useful element in heating the house. He adopts a different position in low latitudes, for example in Kuwait (latitude 29º N), "where the light is so strong that shade is necessary" [7]. This intensity of light is the reason for the depth of the apertures in his houses of Majorca *Can Lis* and *Can Feliz* (latitude 39ºN). This is especially true in *Can Lis*, where the reflection of the sun in the surface of the restless sea intensively amplifies the quantity of light coming into the house, through the windows which open onto the sea:

"We left because of the light. The glare of the sun on the sea was too strong… It has ruined the eyesight of the Danish fishermen." Jørn Utzon [8]

During his trip to Morocco (1947) Utzon was taken by the harmony with which the cities of the desert blend into the landscape thanks to their relation to the sun [9]. His trip to USA had a similar effect on him (1949). *Ken Butti* and *John Perlin*, in their book *A Golden Thread,* state that the rising price of fuel in North America at the beginning of the 40s was a key aspect in making the commercial expansion of the emerging solar architecture possible. In this context, the extra cost of buying a solar house was willingly accepted by the buyer, thanks to the fuel savings on heating, as well as the resultant independence they would clearly gain. This trend would continue up to the end of the 50s, when the fall in fuel prices and the development of heating and mechanical ventilation systems caused its decline [10].

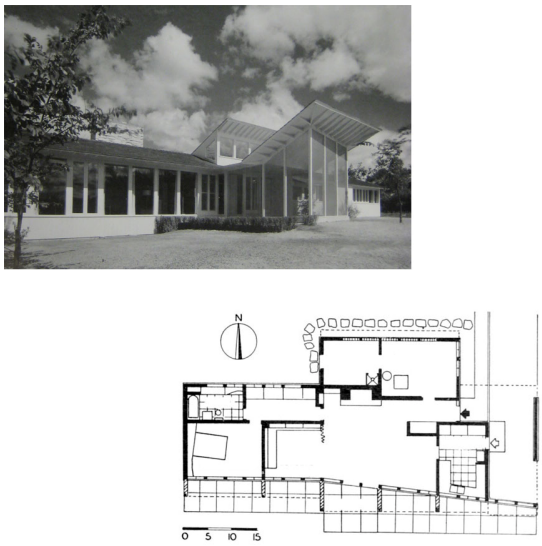

Fig. 4. View of the southern facade, *Howard Sloan's house*, first solar house for domestic use in USA (Illinois, 1940). Plan of *Duncan House* (Illinois, 1941). Both of them designed by *George Fred Keck*. In *Duncan House*, see how living room's window turns looking for south-southwest.

Utzon's trip to the USA took place at the end of the 40s, during the period of expansion in solar architecture in the country. The first residential solar house in the USA was built by the architect *George Fred Keck* in Illinois for the developer *Howard Sloan*. Keck, finally "felt confident enough to expose the whole south facade of the house to the sun" [11].

Essentially, a solar house is a house which optimizes the collection of sunbeams, being oriented to the south, the most favourable for managing temperature. Having a south-orientated facade guarantees maximum exposure to the sun during winter (when the sunbeams have a lower angle and are therefore more perpendicular to the plane of the facade), and the minimum during summer (when due to their higher angle the beams fall parallel or almost parallel to the facade). Secondly, to maximize the benefits of this, the solar house floor plan is rectangular, having one of the long sides oriented to the south, and the apertures being as closed as possible in other directions, to avoid the loss of energy. The selected houses designed by Utzon follow a common pattern, which has remarkable similarities with the American solar houses.

II. List of selected buildings and selection criteria

To analyze the influence of the sun as an organizing element of life in the projects designed by him, I have selected twenty houses and housing complexes built by Utzon between 1950 and 1994:

<u>1950</u>

[1] The architect's house in Hellebæk, 1950-1952 *
[2] *Middelboe House*, Holte, 1953-1955 *
[3] *Herstad House*, Rungsted, 1953-1954 *
[4] *Rotzau-Larsen House*, Rungsted, 1953-1954 *
[5] *Andersen House*, Hillerød, 1953 *
[6] *Milling House*, Hillerød, 1953-1954 *
[7] Housing complex, Elineberg, Helsingborg, 1954-66 *
[8] *Bille House*, Vejby Strand, 1954-1955
[9] *Lillesøe House*, Holte, 1955
[10] *Villa Frank*, Vedbæk, 1956 *
[11] *Villa Dalsgaard*, Holte, 1956
[12] *Kingo housing complex*, Helsingør, 1956 *
[13] Housing complex in Bjuv, 1956 *
[14] *Planetstaden housing complex*, Lund, 1956-1957 *
[15] *Banck House*, Helsingborg, 1958 *

<u>1960</u>

[16] Housing complex in Fredensborg, 1959-1965 *
[17] *Herneryd House*, Helsingborg, 1960-1962 *
[18] *Povl Ahm House*, Harpenden, Hertfordshire, 1964

<u>1970</u>

[19] *Can Lis*, Majorca, 1971-1973 *
[20] *Can Feliz*, Majorca, 1972-1994 *

These selected projects represent more than fifty percent of his work dedicated to residential constructions. The selection criteria are as follows:

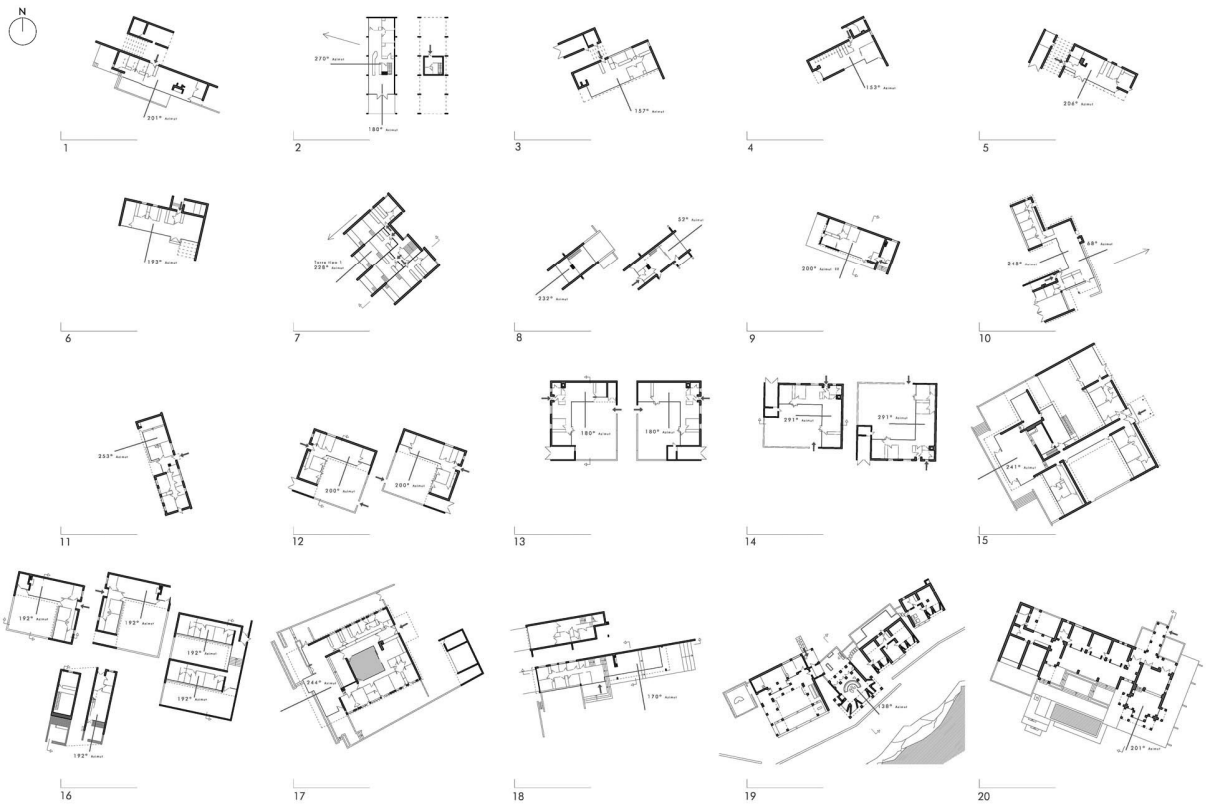

Fig. 5. Plans of twenty selected houses (own elaboration). All the orientations have been searching with Google Earth, except Lillesøe House.

- The construction must have been built (all of them are still standing, except for the *Lillesøe House*, destroyed in a fire, and the *Villa Frank*, demolished in 2009). This aspect is interesting, not only because we have photographic and topographic documentation of the construction, but also because it is always possible to visit the building (houses with * have been visited).

- It has to be a new construction, and not restoration of an existing building. This requirement is important because the design of the building has to be the decision of Utzon, without being bound to other architects decisions.

Once I have selected the projects, in sections III and IV, I will look for patterns in design, orientation and form, and their likely significance.

III. Search for patterns

"The house was built in a forest in order to be protected from the Danish weather. The house is only open to the south, like in traditional Chinese architecture. This is a useful way to shelter from the northwest wind and at the same time to take advantage of the sun. The sunlight in Denmark is very weak, so it is important to get the best use out of it to heat the house. This is the reason why in Denmark there are not big cantilever, but windows made of glass." Jørn Utzon [12]

These patterns are a synthesis of the knowledge acquired during his trips to Morocco, the USA and Mexico, and the work of other architects studied and usually named by him in his writings and interviews (*Wright, Asplund, Aalto, Jacobsen, Eiler Rasmussen, Mies*...). Perhaps *Frank Lloyd Wright* is the architect who had the biggest influence on Utzon in the field of residential architecture.

In the existing bibliography dedicated to research about the orientation of Utzon's houses, it is usually mentioned that he preferred a southerly direction. This is correct but not exact.

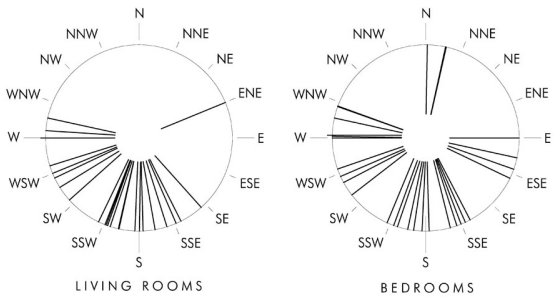

Fig. 6. Orientation diagrams of Utzon's houses (own elaboration). Each line represents the orientation of the analyzed rooms of the projects built between 1950 and 94.

In the previous diagram, the orientation of the living rooms and bedrooms in all twenty selected projects is marked. It is important to specify that generally both rooms in Utzon's houses have windows in just one of the four available walls. This aspect is more typical in the American architecture which he visited during his trip to the USA (*Lloyd Lewis house*, Wright, 1940) than in the Nordic architecture which he was familiar with (*Villa Stennäs*, Asplund, 1937 or *Villa Mairea*, Aalto, 1938). The room is oriented towards the landscape, as is the only existing window. The room is thus conceived as a shelter closed in every direction but one. These openings are in most cases apertures from the floor to the ceiling that are intended to create continuity between the interior and exterior. This property can be observed in Japanese culture, or in Wright's American houses. The architect *Ferrer Forés*, who has studied Utzon's work, defines the *Utzonian* model thus, "the house's geometric simplicity, constructional precision and spatial fluidity, together with the expansion of the domestic area over the outside environment and its openness to the landscape, constitute the essential characteristics of the model of the Utzonian houses" [13]

Regarding the bedrooms, they are freely distributed between easterly, southerly and westerly orientations. Only the upper part of the compass (from northwest to east), remains almost empty, with just a few insignificant examples:

- *Milling House*.
- *Planetstaden housing complex***.** Project developed together with the architects Erik & Henry Anderson. 11 of the 45 courtyard houses have one of their bedrooms oriented to the north (25%).
- Housing complex in Fredensborg. 9 of the 107 houses have a northerly oriented bedroom.

Regarding the living room, we can notice how the most common orientation is between southeast and west. Only one house breaks this rule and one of the two windows of the living room is oriented out of this range:

- *Villa Frank*. This is one of the few houses in which the windows of its living room are oriented in different directions. The reason why this is so is that the view of Øresund (68º east-northeast) and the favourable orientation in relation to the path of the sun are in different directions.

Fig. 7. Dolmen of Viera. The construction is oriented towards the sunrise during equinoxes. A sunbeam reaches into the end of the room at these times. Built in the third millennium BC.

The archeoastronomer *Michael Hoskin* has devoted part of his career to studying the orientations of the megalithic dolmens. Essentially a dolmen is a funerary construction, which generally has just one aperture at the entrance, where the dead bodies lay. The direction of these constructions was carefully chosen. For these people, death didn't mean the disappearance of a person. Their presence in the community extended beyond death, and dolmens became a kind of refuge for the transition. According to Hoskin [14], there are three ultimate factors that have an influence on the decision how to orientate these constructions in one specific region: topographic (like the *tholoi* in Micenas, built in steep slopes), visual (like the *Dolmen of Menga* in Antequera, oriented towards a mountain with an anthropomorphic profile) or astrological (like the *Dolmen of Viera* in Antequera, oriented towards the sunrise during equinoxes).

If we focus on the orientation of the living rooms of the selected Utzon houses, and follow the reasoning of Hoskin, we eliminate the houses which have any of the

following conditioning factors that limit free choice of orientation in the design process:

- Outline (similar to Hoskin's topographical factor) [3, 4, 5, 6, 18]. In this section I have included the houses situated on smallholdings which have a design which is limited by the size and shape of the plot of land. There is not much flexibility to freely choose the orientation of the house [15].

- Visual [2, 7, 10, 11, 15, 17, 19]. In this section I have included houses that have unique views, which determine the orientation of the house.

- Collaboration [7, 8, 11, 13, 14, 15]. The houses designed in collaboration with other architects are not considered, due to the lack of information about who decided the orientation of the house.

- Lack of data about the smallholding [9]. Although it fits the general model, *Lillesøe House* is the only one about which we have no documentation. That is the reason why it is excluded.

Having eliminated the houses in these groups, I looked for a common pattern of orientation in the rest. To do so, I constructed a new diagram of their orientation:

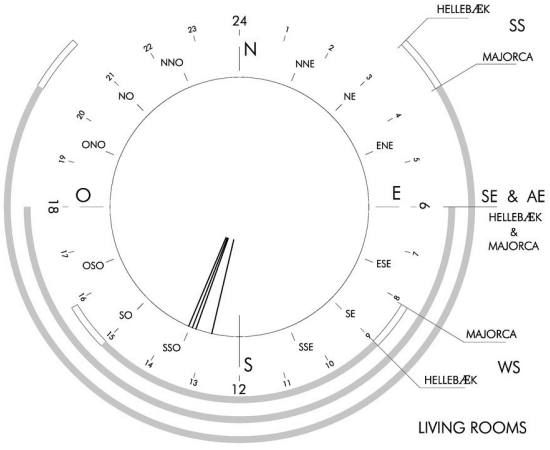

Fig. 8. Orientation diagram (own elaboration). Outside circle, it contains the marks of sunrise and sunset on solstice and equinox for Majorca and Hellebæk [WS – winter solstice, SS – summer solstice, SE – spring equinox, AE – autumn equinox].

There are four houses or housing complexes left: *Utzon House* in Hellebæk, azimuth 201º, *Kingo housing complex* 200º, *housing complex in Fredensborg* 192º and *Can Feliz* 201º. In all of them the living room is oriented almost exactly to the south-southwest (azimuth 202º). Utzon could have come across this orientation during his trip to the USA, thanks to the *Lloyd Lewis House* built and designed by Wright. The house was not far (240 km) from Wright's studio, located in *Spring Green*, *Taliesin East* [16], which Utzon visited during the trip. On the other hand, Utzon himself describes how to orientate his house in Hellebæk in this direction:

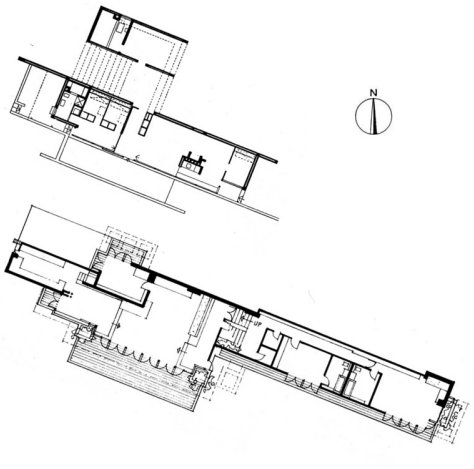

Fig. 9. Above, Utzon's House in Hellebæk (1952). Below, *Lloyd Lewis House* in Wisconsin (1940). Both of them, close to the north side and open to south-southwest.

"We started with a couple of full-scale models made of canvas and board, which gave us an impression of our 130 square meters (the maximum for one-family houses in Denmark) and the possibilities there were for contact with the natural spaces around us: sun, view, shelter and so on. The result of the experiment with the models was that we adopted the principle of a completely closed north side and a completely open glass wall to the south-southwest" Jørn Utzon [17]

To sum up, we can observe the existence of the following patterns in the design of living rooms in the selected houses:

- Orientation: towards the south-southwest (azimuth 202º) in a flexible context without physical, visual or other conditioning factors. This pattern is not related to the latitude, because it is equally respected by houses located in Denmark and Spain.

- Form: living rooms at high latitudes (United Kingdom, Denmark and Sweden) have a rectangular floor plan, unlike the square floor plan in his two houses in Majorca (Spain). Whilst having the same area, the former have a bigger facade facing south, and thus receive more sunbeams.

- Apertures: the windows are always large, from the floor to the ceiling. They are generally located in just one of the perimeter walls of the living rooms and bedrooms. The depth of the apertures in Denmark and Sweden is small or nonexistent. The carpentry work is not set back but levelled to the plain of the facade in order to capture as much light as possible [18]. Conversely, to reduce the light intensity in the houses of Majorca, he used embrasures in *Can Lis* or cantilever in *Can Feliz*.

With the bedrooms he acted more freely and flexibly in setting their configuration. The only element which is repeated is that apertures are not oriented to the north.

IV. Significance of the pattern of south-southwestern orientation

"For while I don't know whether, as the saying goes, 'things which are repeated are pleasing', my belief is that they are significant" Roland Barthes [19]

As was said in section II, the patterns illustrate Utzon´s recurring concern for the wellbeing of the people living in the houses (controlling the quantity of light coming into the house), and for the search for harmony with the environment. Both attitudes are close to the concept which a Greek from *Olynthus* or *Priene* had in the IV century AD, about how a house should be. In both cities, the grid plan dictated expansion along an axis from north to south, and from east to west; this allowed the main room of the house (which today would be the living room) to be oriented to the south. This was a crucial strategy, not only to guarantee the wellbeing of people, but also their survival in a period when glass wasn't yet used for building [20].

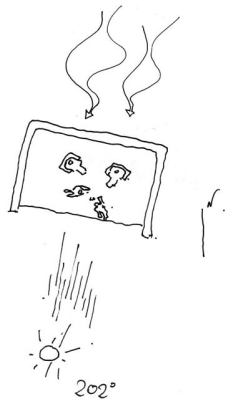

Fig. 10. Living room is thought as a shelter, closes to the north and opens to the south-southwest, 202º azimuth. Sketch (own elaboration).

Utzon does not explain his preference to orient the house towards the south-southwest. Any of the living rooms from the four selected houses could have been oriented to the south, and the projects would essentially not have been modified. In addition, the living rooms of the American houses designed by Keck, the living rooms of the Greek cities of *Olynthus* and *Priene*, or even the living rooms of his own housing complexes in Bjuv or Lund (Sweden), designed in collaboration with the architects Erik and Henri Anderson, are all southern-oriented. But what is the ultimate reason for choosing a southerly orientation? A 22º deviation from south to west has little impact on managing the temperature [21]. Nevertheless, as was pointed out by *Roland Barthes*, the repetition of this orientation pattern must be significant for Utzon.

Fig. 11. A sunbeam going through the gap of the living room *in Can Lis* at 16:11(UTC +1), 6/12/2013 (own photo)

Utzon skilfully exploits the path of the sun, as is proved in *Can Lis*, Majorca. In this house a sunbeam reaches the living room at every sunset, thanks to an opening made in the southwestern living room wall. As can be seen on the overhead plan, should this room have the same design as the two adjacent rooms, the sun would not go through the opening during or around the winter solstice. Should it have the design of the eastern pavilion where the bedrooms are located, the sun could go through the opening only very briefly. But a slight counter-clockwise turn in relation to the neighbouring pavilions allows the sun to go in at every winter solstice sunset. This is the moment of the year when the sun sets the closest to the south, and for example the *caldarium* of the *Baths of Caracalla* in Rome, following the instructions of *Vitruvius* were oriented in this direction:

"In the first place, the warmest possible situation must be selected; that is, one which faces away from the north and northeast. The rooms for the hot and tepid baths should be lighted from the *southwest*, or, if the nature of the situation prevents this, at all events from the south, because the set time for bathing is principally from midday to evening." Vitruvius [22]

Fig. 12. Caldarium of Caracalla's Bath in Rome (211-217 AD) is oriented to the southwest (sunset on winter solstice).

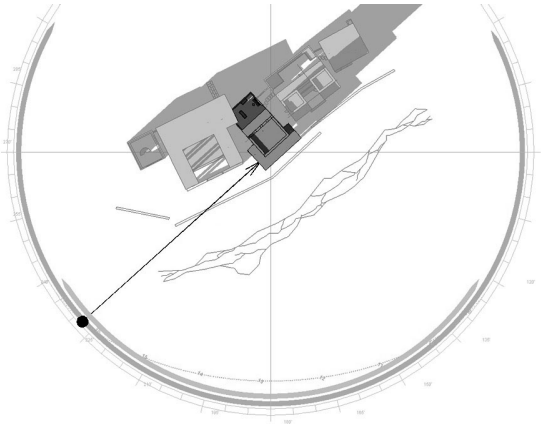

Fig. 13. Solar analysis (own elaboration). *Can Lis*. On the winter solstice, the sunbeams go through the opening at exactly 16:21 (UTC+1) and last almost an hour before the sun sets behind the thick tips of the pines in Mondragó Natural Park.

"Today you can still experience this wonderful variation in feeling from the closeness in the jungle to the vast openness on the platform top. It is parallel to the relief you feel here in Scandinavia when after weeks of rain, clouds and darkness, you suddenly come through all this, out into the sunshine again" Jørn Utzon [23]

The sun reaches the south-southwestern direction at 13:28 solar time, so in Helsingør (Denmark) for example, on the winter solstice this happens at 13:37 (UTC+1), local time. From the moment when the sun reaches the south-southwestern orientation till the moment when it sets that day, 1 hour and 58 minutes pass. This increases to 4 hours 39 minutes at the spring equinox, and 7 hours 22 minutes on the summer solstice. Although during the winter months the sky is usually covered by thick clouds, the decision to choose the southern orientation as in the *Baths of Caracalla* may be intended to improve the collection of the last sunbeams during the most critical day of the year: the winter solstice. The same situation exists in *Can Lis*, where he enabled the sunbeams to pass through the opening. This could also create a good opportunity for the family to gather in this place, as we can observe in the sketch drawn by him for the *Langelinie Pavilion*.

V. Conclusions

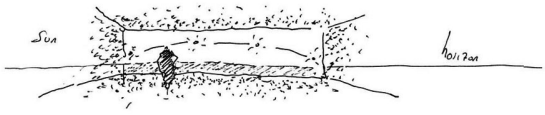

Fig. 14. The whole sun path viewed from the interior of the house-shelter. Sketch (own elaboration).

After having analyzed the selected examples, the following conclusions can be inferred: Utzon proposes a kind of ideal house whose living room is open to the sun path through the use of one large aperture. The room is conceived as a shelter that opens in one direction and is closed to the rest. The bedrooms are freely oriented but their windows never face north. The favourite orientation of the living room is near to south-southwestern direction (azimuth 202º) unless there are external conditioning factors in the place (outline, visual…) This fact ensures the optimal collection of perpendicular sunbeams on the coldest days in winter (the ones nearest the winter solstice). Something similar happens in *Can Lis*, where an opening to the southwest located in the living room wall allows sunbeams to enter the room. In addition, being able to trace the whole sun path from the interior of the house allows the reestablishment of the bond between human being and place. This link existed in ancient cultures like the megalithic, Roman or Greek. The *Baths of Caracalla*, the Roman cities *Olynthus* and *Priene*, the Greek temples of the *acropolis of Selinunte*, the megalithic *Dolmen of Viera*, or the American solar architecture from the forties and fifties, are all examples of constructions designed in relation to the sun and its daily path.

To sum up, Utzon proposes a kind of house which is in harmony with the environment in which it is located, thanks to the fact that it is designed in relation to a timeless element: the path of the sun. He intends to transcend architecture. He looks for transcendence in the lack of authorship. His attitude and postulates are based in experiences and collective memory, and never in something personal or particular. The knowledge of the sun path is rediscovered by Utzon and used in the design of most of his residential projects.

"Karen Blixen, the excellent Danish authoress, relates in *Out of Africa* how she once tried to order her black farmers to build their huts in a line. It was impossible for them to understand the significance of a line. Instead they spread the huts in relation to each other, the sun and the trees" Jørn Utzon [24]

Notes

[1] Climent Guimerá, Federico. *Utzon handmade*. Consejería de Vivienda y Obras Públicas & Colegio Oficial de Arquitectos de las Islas Baleares: Palma, Majorca. 2009. p 74.

[2] Tøjner, Poul Erik . "Architecture as human wellbeing (Interview with Jørn Utzon)" in *Louisiana Revy*, 2, vol. 44, April: Humlebæk. 2004.

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[4] Vila, Tono. "Interview with Jørn Utzon" in *Quaderns d'Arquitectura i Urbanisme*, 157, april-june: Barcelona. 1983.

[5] Ibid.

[6] Utzon, Jørn. "The innermost being of architecture" in Weston, Richard *Jørn Utzon: Inspiration, visión, architecture*. Bløndal: Hellerup. 1948. p 10-11.

[7] Tøjner, op. cit.

[8] Manresa, Andreu. "Interview with Jørn Utzon" in *El País Press,* 7 April: Felanitx, Majorca. 2003.

[9] Tøjner, op. cit.

[10] Butti, Ken, Perlin, John. *A Golden Thread: 2500 Years of Solar Architecture & Technology*. Cheshire Books: Soquel. 1980.

[11] Butti, Ken, Perlin, John, op. cit.

[12] Vila, Tono, op. cit.

[13] Ferrer Forés, Jaime. *Jørn Utzon: works and projects*. Gustavo Gili: Barcelona. 2006. p 104.

[14] Hoskin, Michael. "The Archaeoastronomy of Antequera" in *The Michael Hoskin Solar Centre"*. Junta de Andalucía: Andalusia. 2011. p 237.

[15] An exception is the case of *Can Feliz*, located on a steep slope. It was built on a platform *ex-professo* designed by Utzon. I will consider it outside of the influence of this factor and therefore not include it in this group.

[16] Tøjner, op. cit.

[17] Utzon, Jørn. "Own house in Hellebæk" in *Byggekunst, 5*. 1981.

[18] Vila, Tono, op. cit.

[19] Barthes, Roland. *Mythologies*. The Noonday Press: New York. 1991. p 7.

[20] The first evidence of the use of glass in windows comes from the more upmarket Roman houses in the cities of *Herculaneum* and *Pompeii*, among others. Butti, Ken, Perlin, John, op. cit.

[21] Indeed, the incident solar radiation decreases 10% when facade turns to south-southwest (calculated with sun analysis software for Palma and Copenhagen).

[22] Vitruvius. *The ten books on architecture*. Harvard University Press: Cambridge. 1914.Book V, Chapter X.

[23] Utzon, Jørn. "Platforms and plateaus. Ideas of a Danish architect" in *Zodiac*, 10: Milano. 1962.

[24] Utzon, Jørn. Utzon's project description. Bikerbo housing complex, Helsingør. 1960.